AMENDMENTS TO THE SPECIFICATION:

Please replace paragraph [001] with the following amended paragraph:

[001] This application is a continuation of prior application U.S. Serial No. 10/044,467 filed January 11, 2002, which claims the benefit of U.S. Provisional Patent Application Serial No. 60/261,495, filed on January 12, 2001 and hereby expressly incorporates both by reference.

Please replace paragraph [008] with the following amended paragraph:

[008] Examples of arrangements utilizing both an expansion shell assembly and resin to anchor a mine roof bolt in a rock formation are disclosed in U.S. Pat. Nos. 4,419,805; 4,413,930; 4,516,885 and ~~4,512,292~~ 4,518,292, all expressly incorporated herein by reference. Other examples of both an expansion shell assembly and resin to anchor a mine roof bolt are disclosed in U.S. Pat. Nos. 3,188,815; 4,162,133; 4,655,645 and 4,664,561, all expressly incorporated herein by reference.

Please replace paragraph [0019] with the following amended paragraph:

[0019] FIG. 1a ~~includes~~ is an elevational view ~~and a cross-sectional view~~ of an expansion shell assembly having a support device on a mine roof bolt in a precisely controlled diameter arrangement in accordance with a first preferred embodiment of the present invention;

Please add the following new paragraph after paragraph [0019]:

[0019.1] FIG. 1b is a cross sectional view of the expansion shell assembly of FIG. 1a;

Please replace paragraph [0020] with the following amended paragraph:

[0020] FIG. 2a ~~includes~~ is an elevational view ~~and a cross-sectional view~~ of an expansion shell assembly on a mine roof bolt in a conventional shell arrangement in accordance with a second preferred embodiment of the present invention;

Please add the following new paragraph after paragraph [0020]:

[0020.1] FIG. 2b is a cross section view of the expansion shell assembly of FIG. 2a;

Please replace paragraph [0021] with the following amended paragraph:

[0021] FIG. 3a ~~includes~~ is an elevational view ~~and a cross-sectional view~~ of an expansion shell assembly on a mine roof bolt in a notched shell arrangement in accordance with a third preferred embodiment of the present invention;

Please add the following new paragraph after paragraph [0021]:

[0021.1] FIG. 3b is a cross sectional view of the expansion shell assembly of FIG. 3a;

Please replace paragraph [0022] with the following amended paragraph:

[0022] FIG. 4a ~~includes~~ is an elevational view ~~and a cross-sectional view~~ of an expansion shell assembly on a mine roof bolt in a split shell arrangement ~~and an enlarged partial view of a support device taper and radius~~ in accordance with a fourth preferred embodiment of the present invention;

Please add the following new paragraphs after paragraph [0022]:

[0022.1] FIG. 4b is a cross sectional view of the expansion shell assembly of FIG. 4a;

[0022.2] FIG. 4c is an enlarged partial view of a support device taper and radius of the expansion shell assembly of FIG. 4a;

Please replace paragraph [0023] with the following amended paragraph:

[0023] FIG. 5a ~~includes~~ is an elevational view ~~and a cross-sectional view~~ of the precisely controlled diameter arrangement of FIG. 1 wherein a two-piece support device is substituted for the support device of FIG. 1;

Please add the following new paragraph after paragraph [0023]:

[0023.1] FIG. 5b is a cross sectional view of the precisely controlled diameter arrangement of FIG. 5a;

Please replace paragraph [0024] with the following amended paragraph:

[0024] FIG. 6a ~~includes~~ is an elevational view ~~and a cross-sectional view~~ of the precisely controlled diameter arrangement of FIG. 1 wherein a two-piece support device having an antifriction washer is substituted for the support device of FIG. 1;

Please add the following new paragraph after paragraph [0024]:

[0024.1] FIG. 6b is a cross sectional view of the precisely controlled diameter arrangement of FIG. 6a;

Please replace paragraph [0025] with the following amended paragraph:

[0025] FIG. 7a ~~includes~~ is an elevational view ~~and a cross-sectional view~~ of an expansion shell assembly having an unthreaded support device on a mine roof bolt in a precisely controlled diameter arrangement in accordance with another preferred embodiment of the present invention;

Please add the following new paragraph after paragraph [0025]:

[0025.1] FIG. 7b is a cross sectional view of the expansion shell assembly of FIG. 7a;

Please replace paragraph [0026] with the following amended paragraph:

[0026] FIG. 8a ~~includes~~ is an elevational view ~~and a cross-sectional view~~ of an expansion shell assembly on a mine roof bolt having a support device axially secured between rolled threads and a shoulder of the bolt in a precisely controlled diameter arrangement in accordance with another preferred embodiment of the present invention;

Please add the following new paragraph after paragraph [0026]:

[0026.1] FIG. 8b is a cross sectional view of the expansion shell assembly of FIG. 8a;

Please replace paragraph [0027] with the following amended paragraph:

[0027] FIG. 9a ~~includes~~ is an elevational view ~~and a cross-sectional view~~ of an expansion shell assembly on a mine roof bolt having a support device formed integrally

with the bolt in a precisely controlled diameter arrangement in accordance with a ninth preferred embodiment of the present invention; ~~and~~

Please add the following new paragraph after paragraph [0027]:

[0027.1] FIG. 9b is a cross sectional view of the expansion shell assembly of FIG. 9a;

Please replace paragraph [0028] with the following amended paragraph:

[0028] FIG. 10a ~~includes~~ is an elevational view ~~and a cross-sectional view~~ of an expansion shell assembly having a tapered shell engaged to a tapered support device on a mine roof bolt in accordance with another preferred embodiment of the present invention[[.]]; and

Please add the following new paragraph after paragraph [0028]:

[0028.1] FIG. 10b is a cross sectional view of the expansion shell assembly of FIG. 10a.

Please replace paragraph [0030] with the following amended paragraph:

[0030] Unlike prior art where the support device such as a PALNUT or a jamnut had to be forced axially down the bolt by the expansion shell during tensioning of the bolt, this support device cooperates with the expansion shell base portion in one of two general ways. In one way, as illustrated in at least ~~Figs. 1 through 9~~ Figs. 1a through 9b, the upper end portion of the support device cooperates with the expansion shell base portion to cause the expansion shell base portion to diametrically expand and/or fracture and, at a predetermined axial force, allow the support device to traverse axially therethrough during tensioning of the bolt. In another way, as illustrated in ~~Fig. 10~~ Figs. 10a and 10b, the upper end portion of the support device cooperates with the expansion shell base portion to cause the support device to be held in a fixed, non-rotating position thereby allowing the bolt to advance upwardly at a predetermined torque.

Please replace paragraph [0032] with the following amended paragraph:

[0032] Referring now to the drawings wherein like reference characters represent like elements, with reference to ~~Fig. 1~~ Figs. 1a and 1b, an expansion shell assembly is

shown in a precisely controlled diameter arrangement. The expansion shell assembly connects to a mine roof bolt 12 on a threaded end 14 thereof and comprises an expansion shell 16, a tapered camming plug 18, and a support device 20 according to a first preferred embodiment of the present invention.

Please replace paragraph [0042] with the following amended paragraph:

[0042] With reference to ~~Fig. 2~~ Figs. 2a and 2b, a second preferred embodiment of the present invention is illustrated. In this embodiment, an expansion shell assembly in a conventional shell arrangement comprises the tapered camming plug 18, a support device 60, and a conventional expansion shell 62.

Please replace paragraph [0048] with the following amended paragraph:

[0048] With reference to ~~Fig. 3~~ Figs. 3a and 3b, a third preferred embodiment of the present invention is illustrated. In this embodiment, an expansion shell assembly in a notched shell arrangement comprises the tapered camming plug 18, a support device 80, and a notched expansion shell 82.

Please replace paragraph [0052] with the following amended paragraph:

[0052] With reference to ~~Fig. 4~~ Figs. 4a, 4b and 4c, a fourth preferred embodiment of the present invention is illustrated. In this embodiment, an expansion shell assembly in a split shell arrangement comprises the tapered camming plug 18, a support device 100, and a circumferentially discontinuous expansion shell 102.

Please replace paragraph [0054] with the following amended paragraph:

[0054] The support device 100, like the support devices 20, 60 and 80 has a threaded axial bore for threaded engagement with the bolt 12, a lower end, an upper end whose diameter is less than the lower end, and a surrounding side wall 110 that transitions outwardly from the upper end to the lower end 2. With specific reference to ~~the enlarged partial view of FIG. 4~~ Fig. 4c, the outer transition surface 110 has an outwardly tapered portion 112 beginning at the upper end, a transition radius portion 114 (such as about 0.030 inches), and a straight portion 116 that is parallel to the axial bore ending at the lower end. In this arrangement, the tapered portion 112 is angled at approximately fifty-five degrees relative to the vertical axis of the bolt 12. Of course,

other taper angles can be used to achieve the same result and all such configurations are to be considered within the scope of the present invention.

Please replace paragraph [0056] with the following amended paragraph:

[0056] With reference to ~~Fig. 5~~ Figs. 5a and 5b, an alternative two-piece support device may be used in place of any of the aforementioned support devices 20, 60, 80 or 100. As shown, a two-piece support device 120 is substituted for the support device 20 in the precisely controlled diameter arrangement. The support device 120 comprises a lower threaded ring 122 and an unthreaded upper ring 124. The lower ring 122 has a threaded axial bore 126, a lower end, an upper end, and a surrounding side wall 128. The side wall or outer surface 128 may be circular, hex, or otherwise shaped.

Please replace paragraph [0059] with the following amended paragraph:

[0059] As discussed above, it should be appreciated that a similar two-piece support device may be used with any of the other previously described arrangements. However, an exterior of the upper ring would be shaped like the support device 60, 80 or 100 being substituted. For example, if a two-piece support device is used in place of the support device 60 of ~~FIG. 2~~ Fig. 2a, the upper ring will be shaped like the support device 60 except that the axial bore will be unthreaded. Thus, if the two-piece support device is used in the conventional shell arrangement, a tapered portion of the upper ring will have an angle of approximately ten degrees.

Please replace paragraph [0060] with the following amended paragraph:

[0060] It may also be desirable to add an antifriction washer between the rings of any two-piece support device. With reference to ~~Fig. 6~~ Figs. 6a and 6b, an antifriction washer 140 is provided with the two-piece support device 120 between the lower ring 122 and the upper ring 124. The antifriction washer 140 is one way to reduce the friction between the upper and lower rings 122,124. Installation occurs in the same manner as described with reference to the two-piece support device discussed previously. Also, it should be appreciated that a two-piece support device having an antifriction washer may be used with any other previously described arrangements in the manner described above in reference to the two-piece support device without an antifriction washer.

Please replace paragraph [0062] with the following amended paragraph:

[0062] With reference to ~~FIG. 7~~ Figs. 7a and 7b, another preferred embodiment of the present invention is illustrated. In this embodiment, a mine roof bolt is provided without an unthreaded portion between its threaded end and shoulder. An unthreaded support device is slidably received on the bolt and rests against its shoulder. In many respects the support device of this embodiment is like the upper ring of the two-piece support device. Instead of providing a lower ring, the shoulder of the bolt is used to limit downward axial movement of the support device.

Please replace paragraph [0063] with the following amended paragraph:

[0063] This embodiment may be used with any of the previously described arrangements. However, the outer surface configuration of the support device is dependent upon the shell and support device arrangement desired. In ~~FIG. 7~~ Figs. 7a and 7b, a precisely controlled diameter arrangement is illustrated. Thus, an outer contour or outer transition surface 148 of a support device 150 is like the outer contour of the support device 20 of ~~FIG. 1~~ Figs. 1a and 1b and the precisely controlled diameter shell 16 of ~~FIG. 1~~ Figs. 1a and 1b is provided. Also, the taper angle of a tapered portion 152 of the support device 150 can be like the taper angle of the support device 20 such as sixty degrees. The support device 150 has an unthreaded bore 156.

Please replace paragraph [0064] with the following amended paragraph:

[0064] For installation, the support device 150 is slid onto a bolt 158 that does not have an unthreaded portion between a shoulder 160 and its threaded portion 162. The support device 150 is positioned against the shoulder 160. The precisely controlled diameter expansion shell 16 and the camming plug 18 are placed on the bolt 158 as described in reference to the precisely controlled diameter arrangement of ~~FIG. 1~~ Figs. 1a and 1b. In fact, the remainder of the installation also occurs as described in reference to the precisely controlled diameter arrangement of ~~FIG. 1~~ Figs. 1a and 1b.

Please replace paragraph [0066] with the following amended paragraph:

[0066] Although ~~FIG. 7~~ Figs. 7a and 7b illustrates the precisely controlled diameter arrangement, the support device 150 and/or shell 16 could be modified or substituted to create any of the other aforementioned arrangements. For example, the conventional shell arrangement could be utilized by using a conventional shell 62 and a

support device having an outer contour like that of the support device 60 of ~~FIG. 2~~ Figs. 2a and 2b. Likewise, the notched shell and split shell arrangements could also be utilized by similar modifications and/or substitutions to the shell and the support device.

Please replace paragraph [0067] with the following amended paragraph:

[0067] With reference to ~~Fig. 8~~ Figs. 8a and 8b, another preferred embodiment of the present invention is illustrated. In this embodiment, a bolt 166 includes an unthreaded portion 168 between a threaded end 170 and a shoulder 172 but the threads are rolled on after a support device 174 is slid onto the bolt 166 and positioned adjacent the shoulder 172. Thus, the diameter of an axial bore 176 of the support device 174 is substantially similar to the diameter of the unthreaded portion 168 of the bolt 166.

Please replace paragraph [0068] with the following amended paragraph:

[0068] As described with reference to the support device 160 of ~~FIG. 7~~ Figs. 7a and 7b, an outer surface configuration of the unthreaded support device of this embodiment varies and is dependent upon the shell and support device arrangement desired. In ~~FIG. 8~~ Figs. 8a and 8b, a precisely controlled diameter arrangement is illustrated. Thus, an outer contour or outer transition surface 178 of the support device 174 is like the outer contour of the support device 20 of ~~FIG. 1~~ Figs. 1a and 1b. Also, the taper angle can be like the taper angle of the support device 20 such as sixty degrees.

Please replace paragraph [0069] with the following amended paragraph:

[0069] For manufacture, the support device 174 is slid onto the bolt 166 and positioned adjacent the shoulder 172 prior to the threads being rolled on the bolt 166. The threads are then rolled on the bolt 166 thereby securing the axial position of the support device 174. More specifically, the threads have an outer diameter greater than the diameter of the axial bore 176 of the support device 174 thereby preventing upward axial movement of the support device 174. The shoulder 172 of the bolt 166 prevents downward axial movement. For installation, the expansion shell 16 and the camming plug 18 are placed on the bolt as described in reference to the precisely controlled diameter arrangement of ~~FIG. 1~~ Figs. 1a and 1b. In fact, the remainder of the

installation occurs as described with reference to the precisely controlled diameter arrangement of ~~FIG. 1~~ Figs. 1a and 1b.

Please replace paragraph [0071] with the following amended paragraph:

[0071] Although ~~FIG. 8~~ Figs. 8a and 8b illustrates the precisely controlled diameter arrangement, the support device 174 and/or shell 18 could be modified or substituted to create any of the other aforementioned arrangements. For example, the conventional shell arrangement could be utilized by using a conventional shell 62 and a support device having an outer contour like that of the support device 60 of ~~FIG. 2~~ Figs 2a and 2b. Likewise, the notched shell and split shell arrangements could also be utilized by similar modifications and/or substitutions to the shell and the support device.

Please replace paragraph [0072] with the following amended paragraph:

[0072] With reference to ~~FIG. 9~~ Figs. 9a and 9b, another preferred embodiment of the present invention is illustrated. In this embodiment, a support device 184 is formed integrally with or as part of a bolt 186. Again, the outer surface configuration of the support device varies and is dependent upon the shell and support device arrangement desired. In ~~FIG. 9~~ Figs. 9a and 9b, a precisely controlled diameter arrangement is illustrated. Thus, the outer contour or outer transition surface 188 of the support device 184 is like the outer contour of the support device 20 of ~~FIG. 1~~ Figs. 1a and 1b. Also, the taper angle can be like the taper angle of the support device 20 such as sixty degrees.

Please replace paragraph [0073] with the following amended paragraph:

[0073] Installation occurs like the precisely controlled diameter arrangement of ~~FIG. 1~~ Figs. 1a and 1b except that the support device 184 is already on the bolt 186.

Please replace paragraph [0074] with the following amended paragraph:

[0074] Again, ~~FIG. 9~~ Figs. 9a and 9b only ~~illustrates~~ illustrate the precisely controlled diameter arrangement. Alternatively, the support device 184 and/or shell 18 could be modified or substituted to create any of the other aforementioned arrangements. For example, the conventional shell arrangement could be utilized by using a conventional shell 62 and a support device having an outer contour like that of the support device 60 of ~~FIG. 2~~ Figs. 2a and 2b. Likewise, the notched shell

arrangement and the split shell arrangement could also be utilized in the manner described in reference to the support device 184.

Please replace paragraph [0075] with the following amended paragraph:

[0075] With reference to ~~FIG. 10~~ Figs. 10a and 10b, yet another embodiment of the present invention is illustrated. In this embodiment, an expansion shell assembly comprises the tapered camming plug 18, a support device 190, and an expansion shell 192.

Please replace paragraph [0077] with the following amended paragraph:

[0077] Like the precisely controlled diameter shell 16 of ~~FIG. 1~~ Figs. 1a and 1b, each finger 199 is formed integral at one end portion with the circular base portion 194 and extends upwardly therefrom to form a free end portion for outward expansion of the finger 199. The fingers 199 each have an inner surface for engaging one of a plurality of flat side walls of the camming plug and an outer surface for frictionally engaging a bore hole (not shown) formed in a rock formation.

Please replace paragraph [0079] with the following amended paragraph:

[0079] Installation occurs as described above with reference to the precisely controlled diameter shell arrangement of ~~FIG. 1~~ Figs. 1a and 1b. However, upon continued rotation of the bolt 12 the axial force between the expansion shell 192 and the support device 190 increases. By virtue of this increasing axial force and corresponding increasing friction between the expansion shell 192 and support device 190, the support device 190 is held in a fixed, non-rotating position. Thus at a predetermined bolt torque, the support device 190 is held in a fixed, non-rotating position thereby allowing the bolt 12 to advance upwardly and be properly tensioned.

AMENDMENTS TO THE DRAWINGS:

The attached sheets of drawings include changes to FIGS. 1-10. The attached sheets, which include FIGS. 1a-10b, replace the original sheets. Notably, only the figure labels (e.g., "Figure 1") have been changed.

Attachments: Replacement Sheets
Annotated Sheets Showing Changes